

The same ordinance also provided that in the future women, as well as men, should be invited to entertainments such as weddings, banquets, and the like, where both sexes should mingle in the same hall as in Holland

and England. It was likewise added that these entertainments should conclude with concerts and dances, but that only those should be admitted who were dressed in English costumes. His Majesty set the example in all these changes.

### Discussing the Reading

1. What methods did Peter use to encourage the changes he wanted made? Which of these methods do you think was most offensive to his subjects? Why? Which was the least offensive?
2. Why did seemingly superficial changes in clothing and hair-styles impact so strongly on Russian society?

### CRITICAL THINKING

#### Analyzing Comparisons

Compare the reforms made by Peter the Great with those made by Lycurgus in Sparta (see Reading 4A). Consider the kinds of reforms made, the purpose for the reforms, and the effects the reforms had on the two societies.

## Galileo Defends Scientific Observation

### TIME FRAME

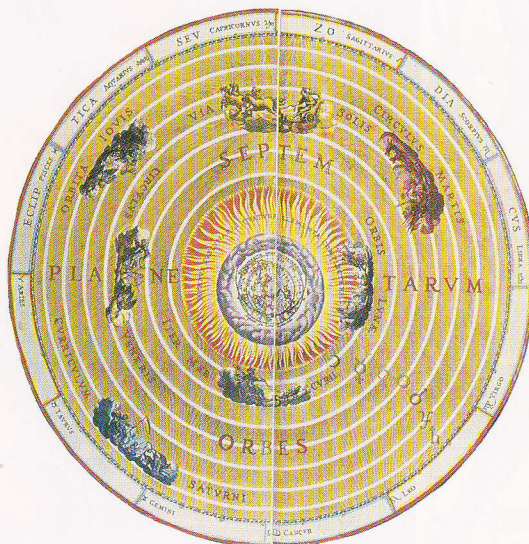
Early 17th century

### GEOGRAPHIC SETTING

Italy

The remapping of the world that took place as a result of the voyages of Renaissance explorers was accompanied by attempts to remap the heavens as well. The theory of the Polish astronomer

Nicolaus Copernicus [kə pər'nə kəs] (1473–1543) that the sun, rather than the earth, was the center of the universe, overturned established belief and was condemned by the Church. Support for



The two diagrams on the opposite page, produced in 1660, show conflicting views on the structure of the solar system. The one on the left shows the traditional arrangement, with the earth at the center, surrounded by the orbits of the sun, moon, and other planets. The diagram on the right shows the solar system as described by Copernicus, with the sun at the center.

the Copernican theory, however, came from the Italian astronomer and mathematician Galileo [gal'ə lā'ō] (1564–1642), who as a result of his observations with the newly developed telescope was convinced that Copernicus was right and that the earth and the other planets as well all revolved around the sun. In 1615 he wrote the following letter to his friend the Grand Duchess Christina, mother of his pupil and patron Cosimo II, Grand Duke of Tuscany, defending his and Copernicus's ideas against the attacks of the Church.

Some years ago, as Your Serene Highness well knows, I discovered in the heavens many things that had not been seen before our own age. The novelty of these things, as well as some consequences which followed from them in contradiction to the physical notions commonly held among academic philosophers, stirred up against me no small number of professors—as if I had placed these things in the sky with my own hands in order to upset nature and overturn the sciences. They seemed to forget that the increase of known truths stimulates the investigation, establishment, and growth of the arts; not their diminution or destruction.

Showing a greater fondness for their own opinions than for truth, they sought to deny and disprove the new things which, if they had cared to look for themselves, their own senses would have demonstrated to them. To this end they hurled various charges and published numerous writings filled with vain arguments, and they made the grave mistake of sprinkling these with passages taken from places in the Bible which they had failed to understand properly, and which were ill-suited to their purposes.

... Men who were well grounded in astronomical and physical science were persuaded as soon as they received my

first message. There were others who denied [my observations] or remained in doubt only because of their novel and unexpected character, and because they had not yet had the opportunity to see for themselves. These men have by degrees come to be satisfied. But some, besides allegiance to their original error, possess I know not what fanciful interest in remaining hostile not so much toward the things in question as toward their discoverer. No longer being able to deny them, these men now take refuge in obstinate silence, but being more than ever exasperated by that which has pacified and quieted other men, they divert their thoughts to other fancies and seek new ways to damage me. . . .

They go about invoking the Bible, which they would have minister to their deceitful purposes. Contrary to the sense of the Bible and the intention of the holy [Church] Fathers, if I am not mistaken, they would extend such authorities until even in purely physical matters—where faith is not involved—they would have us altogether abandon reason and the evidence of our senses in favor of some biblical passage, though under the surface meaning of its words this passage may contain a different sense.

I hope to show that I proceed with much greater piety than they do, when I argue not against condemning this book [by Copernicus], but against condemning it in the way they suggest—that is, without understanding it, weighing it, or so much as reading it. For Copernicus never discusses matters of religion or faith, nor does he use arguments that depend in any way upon the authority of sacred writings which he might have interpreted erroneously. He stands always upon physical conclusions pertaining to the celestial motions, and deals with them by astro-

nomical and geometrical demonstrations, founded primarily upon sense  
 85 experiences and very exact observa-  
 tions. He did not ignore the Bible, but he

knew very well that if his doctrine were  
 proved, then it could not contradict the  
 Scriptures when they were rightly  
 90 understood.

### Discussing the Reading

1. Review Reading 11B. How would Abelard have reacted to Galileo's arguments? How would St. Bernard?
2. Why did Galileo stress (in lines 75–90) that Copernicus had not based his theory on arguments from Scripture?

### CRITICAL THINKING Identifying Assumptions

What assumptions about the relative values of physical evidence and Scriptural authority did Galileo make in this passage?

## Harvey Discovers the Circulation of the Blood

### TIME FRAME

Early 17th century

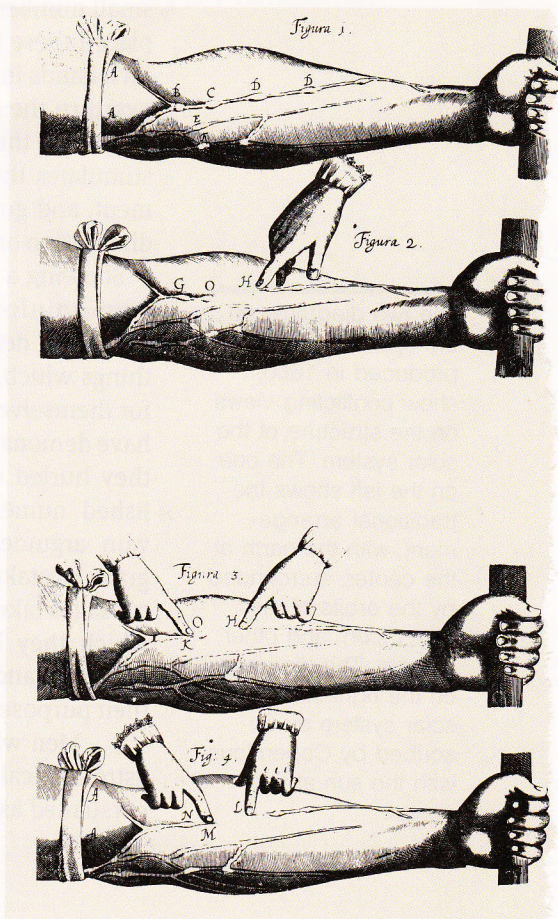
### GEOGRAPHIC SETTING

England

One of the 17th-century scientists most committed to the scientific method of observation was William Harvey (1578–1657), an English doctor. His discovery of the motion of the heart and circulation of blood resulted from long years of study, experimentation, and dissection of animals, as described in his own words below. His discoveries were a profound breakthrough for medical science, because previously physicians thought the liver was also a source of blood. The following excerpt from his *Essay on the Motion of the Heart and the Blood* also emphasizes one of the important characteristics of modern science—the need to communicate results to other scientists.

When I first gave my mind to vivisections [viv'ə sek'shənz; cutting live animals open for experimentation] as a means of discovering the  
 5 motions and uses of the heart, and sought to discover these from actual inspection, and not from the writings of others, I found the task so truly

22B



The diagrams on the opposite page were used by William Harvey in his *Essay on the Motion of the Heart and the Blood*.

arduous, so full of difficulties, that I was  
10 almost tempted to think . . . that the  
motion of the heart was only to be com-  
prehended by God. For I could neither  
rightly perceive at first when the systole  
[sis'tl ē; contraction of the heart] and  
15 when the diastole [dī as'tl ē; dilation of  
the heart] took place, nor when and  
where dilatation and contraction  
occurred, by reason of the rapidity of  
the motion, which in many animals is  
20 accomplished in the twinkling of an  
eye, coming and going like a flash of  
lightning; . . . My mind was therefore  
greatly unsettled, nor did I know what I  
should myself conclude, nor what  
25 believe from others. . . .

At length, and by using greater and  
daily diligence, having frequent  
recourse to vivisections, employing a  
variety of animals for the purpose, and  
30 collating numerous observations, I  
thought that I had attained to the truth,  
that I should extricate myself and  
escape from this labyrinth [maze], and  
that I had discovered what I so much  
35 desired, both the motion and the use of  
the heart and arteries; since which time  
I have not hesitated to expose my views  
upon these subjects, not only in private  
to my friends, but also in public, in my  
40 anatomical lectures, after the manner of  
the Academy [the school founded by  
the Athenian philosopher Plato] of old.

These views, as usual, pleased some  
more, others less; some [criticized] and

45 [slandered] me, and laid it to me as a  
crime that I had dared to depart from the  
precepts and opinion of all anatomists;  
others desired further explanations of  
the novelties, which they said were both  
50 worthy of consideration, and might  
perchance be found of signal use. At  
length, yielding to the requests of my  
friends, that all might be made partici-  
pators in my labors, and partly moved  
55 by the envy of others, who receiving my  
views with uncandid minds and under-  
standing them indifferently, have  
essayed to [slander] me publicly, I have  
been moved to commit these things to  
60 the press, in order that all may be en-  
abled to form an opinion both of me and  
my labors. . . .

### Discussing the Reading

1. What problem did Harvey encounter in attempting to determine how blood was circulated in animals? How did he overcome this problem?
2. Why did Harvey decide to publicize the results of his research?

#### CRITICAL THINKING Making Decisions

What is your opinion on the use of animals in experiments? Should it be limited to medical research? Should it be outlawed altogether?

## Ottoman Military Power

### TIME FRAME

Mid-16th century

### GEOGRAPHIC SETTING

Turkey

The Ottoman Empire was built on the military conquest of vast lands. It then continued to be maintained and administered in part by an elite military group, the Janissary [jan'ə ser'ē] Corps. This group of soldiers were recruited as small children, regardless of their background, and

raised to be completely loyal to the Ottoman sultan. Other official administrators also were selected carefully by the sultan. The following account of the army and the civil service was written by a European who was an ambassador to Constantinople between 1554 and 1562.

23A